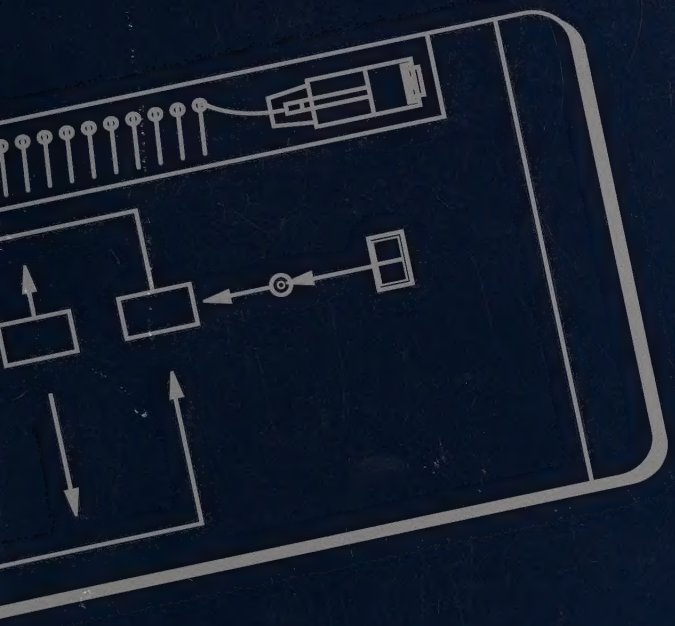
Repeater Power Supply



Operating Manual

TTC™
A Dynatech Company

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T-BERD REPEATER POWER SUPPLY

OPERATING MANUAL

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GENERAL INFORMATION

1.1 INTRODUCTION

This manual provides information on the physical features, functional operation, and specifications of the TTC (Telecommunications Techniques Corporation) T-BERD Repeater Power Supply. This manual also contains general test set-up information for using the T-BERD Repeater Power Supply with the T-BERD 209, 209A, 209*OSP*, or 211 T-Carrier Analyzers.

1.2 INSTRUMENT OVERVIEW

The T-BERD Repeater Power Supply is housed in the lids of the T-BERD 209, 209A, and 211 T-Carrier Analyzers. The T-BERD Repeater Power Supply can also be used with the T-BERD 209*OSP* T-Carrier Analyzer, but it is used as a separate instrument. It enables outside plant technicians to power-up a T-Carrier circuit from the distribution frame in the central office to the customer site for testing the completion of the span. The T-BERD 209, 209A, 209*OSP*, or 211 connected to the T-BERD Repeater Power Supply, is able to stress-test the span by transmitting and receiving patterns. Consult the T-Carrier Analyzer Reference Manual for more detailed instructions and procedures.

The T-BERD Repeater Power Supply with the Loopback connector can be used during troubleshooting or span startup testing to provide power to the span and a hard loop at the distribution frame. This hard loop allows the technician to use the T-Carrier Analyzer to conduct testing at outside plant locations.

The T-BERD Repeater Power Supply delivers a constant current source of 60 mA, 100 mA, or 140 mA. The output voltage varies up to 260 VDC, depending on the number of repeaters powered, span line length, and cable gauge.

When the circuit is disconnected, the voltage potential across the terminals can reach 350 VDC.

WARNING: It is extremely important that the T-BERD Repeater Power Supply be operated only by qualified technicians in accordance with the safety warnings and instructions presented in this manual and printed on the front panel of the unit. Failure to do so could result in serious personal injury.

1.3 STANDARD FEATURES

Span current generation enables testing and verification of newly-installed T-Carrier circuits before span power is applied at the central office.

Internal voltage detector measures the voltage across the circuit to determine whether the applied voltage correlates with the expected voltage dictated by the circuit design.

Internal current detector measures span current to verify proper powering of span repeaters.

Mainframe Interconnect Cable provides a T1 signal interface for the T-Carrier Analyzer.

Loopback Connector enables a single technician to sectionalize T1 span line faults by establishing a hard loop at the central office.

Power supply circuit design and instructions conform to IEEE STD-743.

1.4 ACCESSORIES AND CABLES

1.4.1 Repeater Power Supply Multiplexer (Model #43141)

The Repeater Power Supply Multiplexer is an accessory for the T-BERD Repeater Power Supply that supplies transmit and receive power jacks for six T1 lines, which enable the T-BERD Repeater Power Supply to power up to six T1 circuits from the distribution frame in the central office.

1.4.2 Cables

The following cables are available for the T-BERD Repeater Power Supply and Repeater Power Supply Multiplexer.

Dual 310-to-Dual 310 cable (31442) a pair of these cables is required for connecting the T-BERD Repeater Power Supply to the Repeater Power Supply Multiplexer.

WECO 303-to-Dual 310 cable (43223) provides the transmit and receive connections for three T1 lines from the Repeater Power Supply Multiplexer to the lightning protection block. A pair of these cables is required to power six T1 lines from the Repeater Power Supply Multiplexer for startup testing.

INSTRUMENT CHECKOUT AND SERVICE

2.1 UNPACKING

The T-BERD Repeater Power Supply shipping container should be inspected for damage when it is received. If the shipping container or shipping material is damaged, it should be kept until the contents of the shipment have been inspected for completeness and the instrument has been checked mechanically and electrically. Procedures for checking the electrical performance of the instrument are given in Section 2.5. If the contents are incomplete, or if the T-BERD Repeater Power Supply does not seem to be functioning, the customer should notify TTC. If the shipping container is damaged, notify the carrier as well as TTC, and keep the shipping container and materials for the carrier's inspection.

2.2 EQUIPMENT INCLUDED

The following equipment should be present when the T-BERD Repeater Power Supply is received and unpacked.

- T-BERD Repeater Power Supply
- Operating Manual

2.3 WARNINGS AND CAUTIONS

The following warnings and cautions must be observed before and during all phases of instrument operation. Failure to comply with these and other specific warnings contained elsewhere in this manual may cause physical harm to the operator and/or damage to the instrument. TTC assumes no liability due to the customer's failure to comply with these requirements.

The red LED marked HIGH VOLTAGE is visual indication that power is on. When power is on, personnel must be aware of the safety hazards and act accordingly.

DANGER! HIGH VOLTAGE

Do not operate this equipment in an explosive atmosphere, or close to combustible material or fumes.

ONLY QUALIFIED TECHNICIANS SHOULD USE THIS DEVICE

The T-BERD Repeater Power Supply provides up to 260 VDC and up to 140 mA of current to the T-Carrier span. Therefore, it is extremely important that only qualified technicians operate the T-BERD Repeater Power Supply. These technicians must be aware of and heed the safety warnings and instructions contained in this manual, as well as those printed on the front panel of the unit. Failure to heed these warnings could result in serious personal injury.

Persons with cardiac conditions are at an increased risk of fatal injury when operating the T-BERD Repeater Power Supply. Pregnant women should avoid using the unit, and it should be kept out of the reach of children.

GROUND THE INSTRUMENT

To minimize shock hazard, the instrument chassis must be connected to an electrical ground at the power outlet. Either connect the AC power cord to an approved three-contact electrical outlet or use a three-contact to two-contact adaptor with the grounding wire firmly connected to an electrical ground at the power outlet.

When used with the T-BERD Repeater Power Supply, the chassis of the Repeater Power Supply Multiplexer can be grounded through a separate ground wire connected to the ground contact on the front panel. If the cables between the T-BERD Repeater Power Supply and Repeater Power Supply Multiplexer do not have reliable shield continuity, the separate ground wire from the Repeater Power Supply Multiplexer front-panel ground contact MUST BE USED!

POWER THE T-BERD REPEATER POWER SUPPLY WITH 115 VAC ONLY

To prevent internal damage to the T-BERD Repeater Power Supply, use only 115 VAC ±10% to power-up the unit.

DO NOT OPERATE IN HIGH HUMIDITY ENVIRONMENTS (Rel. Humidity ≥90%)

Do not use the T-BERD Repeater Power Supply in areas of moisture or condensation.

2.4 POWER REQUIREMENTS

The T-BERD Repeater Power Supply requires 115 VAC ±10%.

AC Power connector — The T-BERD Repeater Power Supply AC power cord is plugged into this receptacle to provide line voltage to the unit. The safety ground connection is wired directly to the T-BERD Repeater Power Supply chassis.

AC power cord — This unit is equipped with a three-conductor AC power cord. The AC power cord must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adaptor with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet.

AC line fuse — The AC line fuse is located in the AC Power connector. The T-BERD Repeater Power Supply should be operated with a 1 Amp, 250 V, Slo-Blo fuse (1A Littlefuse #218001 or its equivalent). Always use the correct fuse rating.

POWER switch — The **POWER** switch is located on the side panel next to the AC Power connector.

2.5 INSTRUMENT CHECKOUT

Perform the following procedure to verify T-BERD Repeater Power Supply operation.

1. **Connect to T-Carrier Analyzer**
   Connect the Mainframe Interconnect Cable to the network interface connector on the T-BERD 209A or 211.

Connect the Mainframe Interconnect Cable to the T-BERD 209*OSP* TRANSMIT/TDR and RECEIVE jacks via the 15-pin D to dual WECO 310 connector adaptor cable (Model 42048).

2. **Connect transmit output to receive input**
   Use dual 310 to dual 310 cables or dual bantam to dual bantam cables to connect the transmit and receive sides.

3. **Verify current output**
   Select 60 mA, and verify the span current display reads between 57 mA and 63 mA and the voltage display reads less than 5 volts.

4. **Perform a bit error rate test**
   Perform a bit error rate test. There should be no bit errors in a 15-minute period.

5. **Repeat previous steps**
   Repeat Steps 3 and 4, for the 100 mA and 140 mA settings.

2.6 IN CASE OF DIFFICULTY

If the unit fails to operate, remove power from the T-BERD Repeater Power Supply and check the following:

- AC power cord and AC supply
- AC fuse and fuse size
- Connecting cables
- Mainframe Interconnect cable

WARNING: Remove power from the T-BERD Repeater Power Supply before checking the AC power cord, fuse, 310/bantam cables, and Mainframe Interconnect Cable. Failure to do so could result in serious personal injury.

If the T-BERD Repeater Power Supply fails to operate after the AC power cord, power supply, fuse and cables are found to be in proper working order, contact the TTC Customer Service Department at (800) 638-2049.

2.7 AC LINE FUSE REPLACEMENT

The T-BERD Repeater Power Supply AC line fuse is located in the AC power connector. If the fuse is open, it should be replaced with a 1A 250V, Slo-Blo blow fuse (Littlefuse #218001 or equivalent).

To replace the AC line fuse, perform the following:

WARNING: Remove power from the T-BERD Repeater Power Supply before attempting to access or change the fuse. Failure to remove power before accessing the fuse can result in serious personal injury.

1. **Disconnect the T-BERD Repeater Power Supply AC power cord from the wall outlet**

2. **Open the fuse cover**
   Using a small screwdriver or similar instrument, gently pry the fuse cover open.

3. **Replace the AC line fuse**
   Remove the bad fuse and install a new fuse of the correct size. Use only a 1-amp fuse (1A 250V, Slo-Blo).

4. **Close the fuse cover**
   Press down on the cover until it snaps shut.

2.8 WARRANTY

2.8.1 Warranty Policy

All equipment manufactured by TTC is warranted against defects in material and workmanship. This warranty applies only to the original purchaser and is non-transferable unless express written authorization of the warranty transfer is granted by TTC.

The T-BERD Repeater Power Supply will be repaired or replaced (at our option) at no charge for a period of three (3) years after shipment to the customer. Cables and all equipment other than the above mainframe will be repaired or replaced (at our option) at no charge for a period of one (1) year after shipment to the customer.

Liability under this warranty extends only to the replacement value of the equipment. The warranty is void under the following conditions.

- Equipment has been altered or repaired without specific authorization from TTC.
- Equipment is installed or operated other than in accordance with instructions contained in TTC literature and operating manuals.

2.8.2 In-Warranty Service

Equipment in warranty must be returned to the factory or authorized service center with shipping prepaid. The equipment should be packed and shipped in accordance with instructions in Section 2.9 of this manual. Before returning any equipment, the customer must obtain a Return Authorization (RA) number by contacting the nearest TTC Repair Center. The RA number should appear on all paperwork and be clearly marked on the outside of the shipping container.

After TTC repairs the equipment, it will be tested to applicable specifications and returned to the customer with shipping prepaid. A brief description of the work performed and the materials used will be provided on the Equipment Repair Report furnished with the returned equipment.

2.8.3 Out-of-Warranty Service

The procedure for repairing out-of-warranty equipment is the same as that used for equipment still in warranty. However, there is a minimum charge applied to each request for out-of-warranty service. The minimum charge guarantees the customer an estimate of the repair costs and is used as credit against actual materials and labor costs should the equipment be repaired. Contact the nearest TTC Repair Center for specific information on the minimum out-of-warranty charge.

The customer will be billed for parts plus standard rates in effect at the time of repair. The customer will also be required to furnish a purchase order number before repair work can be started, and TTC (or the authorized service center) must receive a hard copy of the purchase order before the repaired equipment may be shipped to the customer. A description of the labor and materials used will be provided in the Equipment Repair Report.

Once an out-of-warranty repair is made, the repaired part or component is warranted for one (1) year. This warranty applies only to the part or component that was repaired; other parts or components are not covered under the one (1) year repair warranty.

2.9 EQUIPMENT RETURN INSTRUCTIONS

To all equipment returned for repair, attach a tag that includes the following information.

- Owner's name and address.
- A list of the equipment being returned and the applicable serial number(s).
- A detailed description of the problem or service requested.
- The name and telephone number of the person to contact regarding questions about the repair.
- The Return Authorization (RA) number.

If possible, the customer should return the equipment using the original shipping container and material. If the original container is not available, the unit should be carefully packed so that it will not be damaged in transit. TTC is not liable for any damage that may occur during shipping. The customer should clearly mark the TTC-issued RA number on the outside of the package and ship it prepaid and insured to TTC.

INSTRUMENT DESCRIPTION

3.1 INTRODUCTION

This section can be used as a reference during testing and as a guide to understanding the functions of the T-BERD Repeater Power Supply and the Repeater Power Supply Multiplexer.

The controls, indicators, and connections for the T-BERD Repeater Power Supply (see Figure 3-1) are grouped into the following functional areas.

Test Setup — Describes the controls used to configure the T-BERD Repeater Power Supply to provide a specific span current.

Circuit Connections — Discusses the available connections used to provide access to the span and to enable testing of the span by the T-Carrier Analyzer.

Repeater Power Supply Multiplexer — Introduction — Presents a brief description of the Repeater Power Supply Multiplexer and its function.

Repeater Power Supply Multiplexer — Test Connections — Discusses the available Repeater Power Supply Multiplexer connections used to provide access to the span and to enable testing of up to six T1 span lines by an outside plant T-Carrier Analyzer.

Figure 3-1
T-BERD Repeater Power Supply Front Panel

3.2 TEST SETUP

The following controls and indicators are described in the order that you would normally use them to provide span current to a repeater span for testing with a T-Carrier Analyzer:

3.2.1 POWER Switch (1)

This switch controls the AC power to the T-BERD Repeater Power Supply. Always place the switch in the OFF position before connecting the AC power cord.

3.2.2 60 mA, 100 mA, 140 mA Switch (2)

This three-position switch selects the desired simplex current to be applied to the T-Carrier span. The setting is determined by the user, and is based on the repeater type used in the span.

3.2.3 High Voltage LED (3)

The red LED power indicator labeled HIGH VOLTAGE indicates that power is being applied to the unit and that high voltage is being delivered across the transmit and receive pairs. The red LED will be on continuously when the current is established. The red LED flashes if power is applied to the T-BERD Repeater Power Supply and the current loop is not established. While the red LED is flashing, current is being pulsed on the span.

3.2.4 CURRENT (mA) Display (4)

The display labeled CURRENT (mA) gives a three-figure reading of the current being drawn by the T-Carrier circuit. It has a range of 0 mA to 399 mA. The display reading is only valid when the red High Voltage LED illuminates continuously.

3.2.5 VOLTAGE (VDC) Display (5)

The display labeled VOLTAGE (VDC) gives a three-figure reading of the voltage applied to the circuit. It has a range of 0 VDC to 399 VDC. The display reading is only valid when the red High Voltage LED illuminates continuously.

3.3 CIRCUIT CONNECTIONS

The following are used to connect the T-BERD Repeater Power Supply to the distribution frame of the span and to a T-Carrier Analyzer:

3.3.1 TRANSMIT CURRENT OUT and RECEIVE CURRENT IN Jacks (6)

There are two sets of cable jacks for both the Transmit and Receive sides. One set is compatible with a dual 310 jack, and the other set is compatible with a dual bantam jack. The TIP and RING signals are provided on the tips of the dual connectors, and the shields of the jacks are connected to the chassis. These dual jacks are compatible with cables used in the central office to access signals at the lightning protectors in the distribution frame.

3.3.2 Mainframe Interconnect Cable (7)

This coiled cable with a 15-pin D connector, located in the T-BERD Repeater Power Supply cord tray, connects to the 15-pin D network interface connector on the T-BERD 209, 209A, or 211. The Mainframe Interconnect Cable can be attached to the T-BERD 209*OSP* RECEIVE and TRANSMIT/TDR jacks via a 15-pin D to dual WECO 310 connector adaptor cable (Model 42048). This connection enables the T-Carrier Analyzer to test the span through the T-BERD Repeater Power Supply interface with the span.

3.3.3 Loopback Connector (8)

This is a 15-pin D connector with a hard-wired loopback that connects to the end of the Mainframe Interconnect Cable. Attaching the Loopback Connector to the Mainframe Interconnect Cable establishes a hard loopback at the T-BERD Repeater Power Supply, which enables a technician to take the T-Carrier Analyzer to mid-span for troubleshooting or startup testing. The signal level at the distribution frame should be measured prior to connecting the Loopback Connector to the Mainframe Interconnect Cable. To ensure proper operation, the signal level should be -15 dBdsx or greater.

3.4 REPEATER POWER SUPPLY MULTIPLEXER — INTRODUCTION

The Repeater Power Supply Multiplexer allows the T-BERD Repeater Power Supply to power up to six T1 circuits from the distribution frame of the span on at a time. There are no switches on the Repeater Power Supply Multiplexer.

3.5 REPEATER POWER SUPPLY MULTIPLEXER — TEST CONNECTIONS

The following connectors are used to connect the Repeater Power Supply Multiplexer to the T-BERD Repeater Power Supply and the distribution frame of the span (see Figure 3-2).

3.5.1 TRANSMIT CURRENT OUT Jacks (1)

There are two cable jacks for the TRANSMIT CURRENT OUT jacks. The pair of cable jacks is used with a dual 310 to dual 310 cable to connect the T-BERD Repeater Power Supply TRANSMIT CURRENT OUT jacks to the Repeater Power Supply Multiplexer TRANSMIT CURRENT OUT jacks. The TIP and RING signals are provided on the tips of the dual connectors, and the shields of the jacks are connected to the chassis.

3.5.2 RECEIVE CURRENT IN Jacks (2)

There are two cable jacks for the RECEIVE CURRENT IN jacks. The pair of cable jacks is used with a dual 310 to dual 310 cable to connect the T-BERD Repeater Power Supply RECEIVE CURRENT IN jacks to the Repeater Power Supply Multiplexer RECEIVE CURRENT IN jacks. The TIP and RING signals are provided on the tips of the dual connectors, and the shields of the jacks are connected to the chassis.

3.5.3 LINE 1 To LINE 6 TRANSMIT Jacks (3)

The top pair of cable jacks for LINE 1 to LINE 6 are the TRANSMIT jacks. The TRANSMIT jacks are used with a dual 310 cable to connect to the distribution frame lightning protectors. The TIP and RING signals are provided on the tips of the dual connectors, and the shields of the jacks are connected to the chassis. These dual jacks are compatible with cables used in the central office to access signals at the distribution frame lightning protectors.

Figure 3-2
Repeater Power Supply Multiplexer Front Panel

3.5.4 LINE 1 To LINE 6 RECEIVE Jacks (4)

The bottom pair of cable jacks for LINE 1 to LINE 6 are the RECEIVE jacks. The RECEIVE jacks are used with a dual 310 cable to connect to the distribution frame lightning protectors. The TIP and RING signals are provided on the tips of the dual connectors, and the shields of the jacks are connected to the chassis. These dual jacks are compatible with cables used in the central office to access signals at the distribution frame lightning protectors.

3.5.5 GND Connector (5)

The GND (ground) connector provides ground protection for the Repeater Power Supply Multiplexer and T-BERD Repeater Power Supply when there is no grounding wire connection for the AC power cord at the electrical outlet.

OPERATION

4.1 INTRODUCTION

This section provides step-by-step instructions on using the T-BERD Repeater Power supply in conjunction with a T-BERD T-Carrier Analyzer (T-BERD 209, T-BERD 209A, T-BERD 209*OSP*, or T-BERD 211) to power-up and stress-test a T-Carrier circuit. General instructions on stress-testing a circuit with the T-BERD T-Carrier Analyzer have been included in these instructions; for further instructions consult your T-BERD T-Carrier Analyzer Reference Manual or User's Guide.

WARNING: It is extremely important that the T-BERD Repeater Power Supply is operated only by qualified technicians in accordance with the safety warnings and instructions presented in this manual and printed on the front panel of the unit. Failure to do so could result in serious personal injury.

4.2 STANDARD TEST SET-UP

Perform the following procedure to use the T-BERD Repeater Power Supply to power up a T1 circuit for testing with a T-Carrier Analyzer (see Figure 4-1).

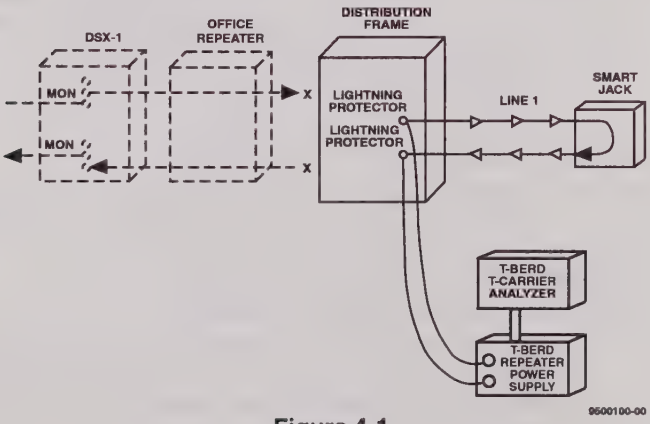

Figure 4-1
Test Set-Up Diagram

T-BERD Repeater Power Supply Setup

1. **Connect transmit and receive cables to the T-BERD Repeater Power Supply**

   Insert dual 310 connectors or dual bantam connectors into the appropriate transmit and receive jacks on the T-BERD Repeater Power Supply. In the central office (CO) distribution frame, use a W4CJ test access cord for 303-type protection blocks, or use a W4BR test access cord for 302-type and 308-type protection blocks.

   WARNING: At this point, **DO NOT** apply power to the T-BERD Repeater Power Supply. When the T-BERD Repeater Power Supply is powered-up, there is a potential of 350 VDC across the terminals which could result in serious personal injury.

2. **Connect transmit and receive cables to the CO lightning protection block**

   Remove lightning protectors from the central office distribution frame (protection block). Insert transmit and receive cable connectors from the T-BERD Repeater Power Supply into the sockets vacated by the lightning protectors.

3. **Connect the Mainframe Interconnect Cable**

   If the T-BERD Repeater Power Supply is going to be connected to a T-Carrier Analyzer at the CO, connect the Mainframe Interconnect Cable to the network interface connector on the T-BERD 209, 209A, or 211 or to the TRANSMIT/TDR and RECEIVE jacks on the T-BERD 209*OSP* using the 15-pin D to dual WECO 310 adaptor cable (Model 42048).

   WARNING: Make sure that power has NOT been applied to the T-BERD Repeater Power Supply. Failure to do so may result in serious personal injury.

   If the T-Carrier Analyzer is providing outside plant testing while the T-BERD Repeater Power Supply is being used to supply power to the T1 span, connect the Loopback Connector to the end of the Mainframe Interconnect Cable to provide a hard loop of the signal at the CO.

4. **Connect AC power cord to the T-BERD Repeater Power Supply**
   Connect the AC power cord from the T-BERD Repeater Power Supply to a 120 VAC wall outlet. At this point, **DO NOT** apply power to the T-BERD Repeater Power Supply.

5. **Select the appropriate current (60 mA, 100 mA, or 140 mA)**
   Select the appropriate current using the **60 mA, 100 mA, 140 mA** switch. The appropriate current is determined by the type of repeater in the T-Carrier circuit under test. The typical selection is 60 mA.

6. **Apply power to the T-BERD Repeater Power Supply**
   Ensure the appropriate current is selected and all transmit and receive cables are connected to the T-BERD Repeater Power Supply and the central office distribution frame. Press the **POWER** switch to ON.

7. **Verify startup**
   When power is applied to the T-BERD Repeater Power Supply, the red High Voltage LED flashes. This is the signal that current is passing through the T-BERD Repeater Power Supply.

8. **Verify circuit path**
   When the current path is completed through the circuit, the red High Voltage LED illuminates continuously, and the VOLTAGE and CURRENT displays show current and voltage measurements. If the VOLTAGE and CURRENT displays show the expected current and voltage values, proceed with the following steps. Refer to Section 4.4 for information on computing the expected voltage measured across the transmit and receive pairs.

   If the red High Voltage LED flashes continuously, the circuit path cannot be completed, suggesting there may be an open circuit or other type of wiring fault.

   NOTE: If transmit and receive connections are reversed, the measured voltage will be much less than expected.

T-BERD 209, 209A, 209OSP, or 211 Setup

1. Apply power to the T-BERD T-Carrier Analyzer

2. Configure the T-Carrier Analyzer

If the T-Carrier Analyzer is providing outside plant testing at span repeater housings, use the appropriate configuration and test procedure from the test set User's Guide. Skip to *Shutting Down After the Test.*

If the T-Carrier Analyzer is connected to the T-BERD Repeater Power Supply at the central office, configure the test set as follows:

MODE	Select the appropriate mode (T1 D4, T1 ESF, etc.).
RECV'D	Select internal timing (LED OFF).
TIMED TEST	Continuous (LED extinguished).
RECEIVE INPUT	TERM.
B8ZS	ON (LED illuminated), if appropriate.

3. Set the line build-out

Set the line build-out to the desired setting (typically -7.5 dB) using the **LBO (dB)** switch (**TRANSMIT OUTPUT** switch). If you are unsure of the setting, the setting should be such that the sum of the receive level measurement (RX LEVEL) and the selected transmit line build-out is between -15 and -22.5 dBdsx (RX LEVEL + LBO = -15 to -22.5 dBdsx).

4. Loop up CSU or smart jack

If you desire, a loop code can be sent to the far end to loop CSUs or smart jacks. If looping is required, refer to the auxiliary functions to ensure that the proper loop code is selected, and then press the **LOOPUP** switch located on the T-BERD 209, 209A, 209OSP, or 211.

5. Verify the loopback is established

If a loopback is established, the Pattern Sync and Frame Sync LEDs (if appropriate) should illuminate.

6. Check for bit errors

Scroll the bit error result (Result # 00) into one of the results displays. If bit errors are occurring, possible span problems could include faulty repeaters, improper wiring, bridge taps, or loading coils.

7. Conduct testing

Perform the desired tests on the repeater span (e.g., BRIDGTAP or MULTIPAT patterns, Loss testing, etc.).

Shutting Down After the Test

1. Power down the T-BERD Repeater Power Supply

When you have completed testing and are ready to end the test, remove power from the T-BERD Repeater Power Supply before taking any other action.

WARNING: Disconnecting cables from the T-BERD Repeater Power Supply or from the central office distribution frame before removing power from the T-BERD Repeater Power Supply creates a potential of up to 350 VDC across the terminals, which may result in serious personal injury.

2. Disconnect from the circuit

When the red High Voltage LED is no longer illuminated, remove the cables from the central office distribution frame and replace the lightning protectors. Remove the dual 310 or dual bantam cables from the jacks of the T-BERD Repeater Power Supply.

3. Disconnect from the T-Carrier Analyzer

Disconnect the Mainframe Interconnect Cable from the T-BERD 209, 209A, or 211 network interface connector. Disconnect the 15-pin D to dual WECO 310 connector adaptor from the T BERD 209*OSP* and from the Mainframe Interconnect Cable.

4. Remove power from the T-Carrier Analyzer

4.3 START UP TESTING OF MULTIPLE T1 LINES
Repeater Power Supply Multiplexer Required

This procedure enables a single technician to connect the T-BERD Repeater Power Supply and Repeater Power Supply Multiplexer to up to six T1 circuits at the CO lightning protection block. Then, the technician goes to the first repeater apparatus case and tests backward toward the CO on each of the connected T1 circuits. If no problems are found, the technician proceeds to the second repeater apparatus case and repeats the tests. This process continues until the technician reaches the customer premises. If no problems are found, all six T1 circuits are qualified and tagged for service.

Perform the following procedure to use the T-BERD Repeater Power Supply to conduct startup testing on up to six T1 circuits using the T-BERD 209*OSP* (see Figure 4-2).

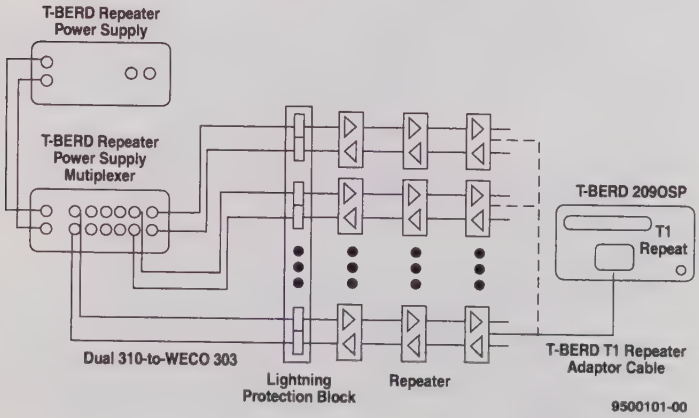

Figure 4-2
Start Up Testing of Multiple T1 Lines

T-BERD Repeater Power Supply Setup

1. **Connect transmit cable to the Repeater Power Supply Multiplexer**

   Insert the dual 310 connectors from one end of a dual 310-to-dual 310 cable (model 31442) into the TRANSMIT CURRENT OUT jacks of the T-BERD Repeater Power Supply. Then, connect the dual 310 connectors on the other end of the cable into the TRANSMIT CURRENT OUT jacks of the Repeater Power Supply Multiplexer.

   WARNING: At this point, **DO NOT** apply power to the T-BERD Repeater Power Supply. When the T-BERD Repeater Power Supply is powered-up, there is a potential of 350 VDC across the terminals which could result in serious personal injury.

2. **Connect receive cable to the Repeater Power Supply Multiplexer**

   Insert the dual 310 connectors from one end of a dual 310-to-dual 310 cable (model 31442) into the RECEIVE CURRENT IN jacks on the T-BERD Repeater Power Supply. Then, connect the dual 310 connectors on the other end of the cable into the RECEIVE CURRENT IN jacks on the Repeater Power Supply Multiplexer.

3. **Connect the LINE 1 through LINE 3 transmit and receive cables**

   Using the WECO 303-to-Dual 310 cable, insert the dual 310 connectors from each cable (LINE 1, LINE 2, and LINE 3) into the appropriate TRANSMIT and RECEIVE jacks on the Repeater Power Supply Multiplexer.

4. **Connect LINE 1 through LINE 3 to the CO lightning protection blocks**

   Remove lightning protectors from the CO distribution frame for the three T1 lines to be tested. Using the WECO 303-to-Dual 310 cable, insert transmit and receive cable connectors from the Repeater Power Supply Multiplexer TRANSMIT and RECEIVE jacks into the appropriate sockets vacated by the lightning protectors.

5. **Repeat Steps 3 and 4 for LINE 4 through LINE 6**
   Repeat the transmit and receive cable connections for LINE 4 through LINE 6.

6. **Connect the Loopback Connector on the T-BERD Repeater Power Supply**
   Connect the Loopback Connector to the end of the Mainframe Interconnect Cable to provide a hard loop of the signal at the CO.

7. **Connect AC power cord to the T-BERD Repeater Power Supply**
   Connect the AC power cord from the T-BERD Repeater Power Supply to a 120 VAC wall outlet.

   NOTE: If a proper ground connection is not available at the electrical outlet for the AC power cord, connect a wire from an electrical ground connector to the GND connector on the Repeater Power Supply Multiplexer to safely ground the chassis.

   WARNING: Ensure that the **POWER** switch is in OFF before connecting the AC power cord to the wall outlet. Failure to do so could result in serious personal injury.

8. **Select the appropriate current (60 mA, 100 mA, or 140 mA)**
   Select the appropriate current using the **60 mA, 100 mA, 140 mA** switch on the T-BERD Repeater Power Supply. The appropriate current is determined by the type of repeater in the T-Carrier circuit under test. The typical selection is 60 mA.

9. **Apply power to the T-BERD Repeater Power Supply**
   Ensure the appropriate current is selected and all transmit and receive cables are connected to the Repeater Power Supply Multiplexer and the CO distribution frame. Press the **POWER** switch to ON.

10. **Verify startup**
    When power is applied to the T-BERD Repeater Power Supply, the red High Voltage LED flashes. This indicates that current is passing through the T-BERD Repeater Power Supply.

11. Verify Circuit path

When the current path is completed through the circuit, the red High Voltage LED illuminates continuously, and the VOLTAGE and CURRENT displays show current and voltage measurements. If the VOLTAGE and CURRENT displays show the expected current and voltage values, the current path is established. Refer to Section 4.4 for information on computing the expected voltage measured across the transmit and receive pairs.

If the red High Voltage LED flashes continuously, the current path cannot be completed, suggesting there may be an open circuit or other type of wiring fault.

NOTE: If transmit and receive connections are reversed, the measured voltage will be much less than expected.

4.4 VOLTAGE DROP COMPUTATIONS

This section presents the method for computing the expected voltage drop in a repeatered span line. The voltage drop across the transmit and receive pairs of a T-Carrier circuit is dependent upon the repeater type, cable gauge, and the length of the cable sections.

The following formula can be used to compute the expected span line voltage drop.

(# repeaters x Vrpt) + (Vcable x kft of cable) = Total Vdrop

Where Vrpt is the voltage per repeater and Vcable is the voltage drop per 1000 feet of cable. The following factors affect the resulting value for Vdrop:

- If transmit and receive connections are reversed, the measured voltage will be much less than expected. Typically, Vrpt, when current is reversed, is between 1 and 2 volts.

- Office repeaters and NIUs drop additional voltage not shown in the formula. Subtract an additional 8 to 16 volts for each transmission device the current passes through.

- A CSU drops additional voltage not shown in the formula. Subtract an additional 14 to 24 volts for the voltage drop across the CSU.

The typical voltage drop for various repeater types is shown in Table 4-1. The typical voltage drop for various cable gauges is shown in Table 4-2.

Table 4-1
Typical Repeater Voltage Drop

Voltage Drop/Repeater (Vrpt)			
Repeater Type	**60mA**	**100 mA**	**140 mA**
238 A/B	7.0	7.1	7.2
239 A/B	7.6	8.2	8.7
239E	8.4	9.6	10.7

Table 4-2
Typical Cable Gauge Voltage Drop

Voltage Drop/kft (Vdrop)			
Cable Gauge	**60 mA**	**100 mA**	**140 mA**
26	2.7	4.5	6.3
24	1.7	2.8	4.0
22	1.1	1.8	2.6
19	0.5	0.8	1.2

SPECIFICATIONS

5.1 GENERAL SPECIFICATIONS

5.1.1 Physical

Size:	13.5 "L x 6 "W x 2.8 "D (34.3 cm x 15.2 cm x 7.1 cm).
Weight:	6.5 pounds (2.9 kg).

5.1.2 Operational

Operating Temperature Range:	0°C to 45°C (32°F to 113°F).
Operating Humidity:	90% Maximum non-condensing.
Storage Temperature Range:	-20°C to 70°C (-4°F to 158°F).
Storage Humidity:	5% to 95% non-condensing.
Power:	115 VAC ±10% at 60 Hz ±10%.
Fuse:	1-amp slow blow fuse (1A 250V, Slo-Blo).

5.2 OUTPUT SPECIFICATIONS

Output Connectors:	Dual 310 tip-to-tip jacks. Dual bantam tip-to-tip jacks. 15-pin D Interface Connector (see Table 5-1).
Repeater Power Current:	60 mA ±5%. 100 mA ±5%. 140 mA ±5%.

Table 5-1
15-Pin D Interface Connector Pin Configuration

Pin Number	Pin Name
1	Transmit Tip
2, 4, 12	Not used
3	Receive Tip
5, 6, 7, 8, 10	Not used
9	Transmit Ring
11	Receive Ring
13, 14, 15	Reserved

Open Circuit Voltage:	260 VDC nominal, 350 VDC maximum.
Operating Voltage:	Determined by the load.
Pulsed Current Mode:	On when circuit current is below 40 mA.
Pulse Rate:	1.25 Hz nominal.
Pulse Duration:	10 ms.
Constant Current Mode:	On when circuit current is above 40 mA.
Pulsed to Continuous Current Delay:	5 seconds nominal.
Continuous to Pulsed Current Delay:	2 seconds nominal.

5.3 MEASUREMENTS

5.3.1 Voltage Measurement

Range:	0 - 399 VDC.
Accuracy:	±5%.

5.3.2 Current Measurement

Range:	0 - 399 mA.
Accuracy:	±5%.

5.4 REPEATER POWER SUPPLY MULTIPLEXER SPECIFICATIONS

5.4.1 Physical

Size:	13.5 "L x 6 "W x 2.8 "D (34.3 cm x 15.2 cm x 7.1 cm).
Weight:	X.X pounds (X.X kg).

5.4.2 Operational

Operating Temperature Range:	0°C to 45°C (32°F to 113°F).
Operating Humidity:	90% Maximum non-condensing.
Storage Temperature Range:	-20°C to 70°C (-4°F to 158°F).
Storage Humidity:	5% to 95% non-condensing.

5.4.3 INPUT Specifications

Input Connectors:	Dual 310 tip-to-tip jacks.

5.4.4 OUTPUT Specifications

Output Connectors:	Dual 310 tip-to-tip jacks.
Repeater Power Current:	60 mA ±5%. 100 mA ±5%. 140 mA ±5%.
Wait State Duration:	60 seconds ±10%.

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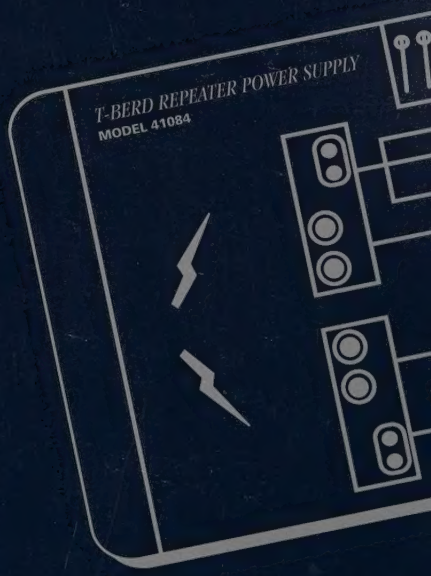

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